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Long-term Ecological Monitoring Field Sampling Plan for 2003

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June 2003

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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ABSTRACT

This Field Sampling Plan (FSP) for the Long-term Ecological Monitoring (LTEM) Project describes the field investigations to be conducted at the Idaho National Engineering and Environmental Laboratory (INEEL) in 2003. This FSP and the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 2002b) constitute the sampling and analysis plan supporting LTEM. The data collected under this plan will become part of the LTEM data set that will be collected annually. The data will be used to determine the requirements for the subsequent LTEM that may last for decades.

The primary goals of the LTEM Plan, in coordination with other monitoring plans at the INEEL, include:

- Verifying that the remedial objectives specified in INEEL Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Records of Decision (RODs) are maintained for ecological receptors

- Determining whether legacy contamination in the soil and water of the INEEL has unacceptable long-term Site-wide ecological impacts

- Identifying and quantifying adverse ecological effects, if any, resulting from INEEL contamination

- Selecting and evaluating appropriate ecological indicators for long-term monitoring.

This FSP provides guidance for site-specific investigation in 2003, including sampling, quality assurance, quality control, analytical procedures, and data management. Use of this FSP helps ensure that data are scientifically valid, defensible, and of known and acceptable quality.

The areas to be characterized as part of this FSP include Ordnance Group #1 (Fire Station II Zone and Range Fire Burn Area, National Oceanic and Atmospheric Administration Grid, and Experimental Field Station), Test Reactor Area, and two terrestrial reference areas. Both analytical and effects data will be collected during the 2003 field activities. Analytical data will include biotic, such as whole mice and plant tissues, and abiotic (i.e., soil) samples. Effects data collected will range from surveys of vegetative cover and small mammal population estimates to histopathology studies of captured mice.

The goal of this FSP is to collect sufficient data to meet the objectives of the LTEM Plan. The primary objective is to determine if contaminant concentrations in each area of concern (AOC) are elevated in comparison with the background and to determine if effects are evident.

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ACRONYMS

AOC	area of concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
COC	chain of custody
COPCs	contaminants of potential concern
CV	coefficient of variation
DAR	Document Action Request
DOE	Department of Energy
DQO	data quality objective
DS	decision statement
EPA	Environmental Protection Agency
ER	environmental restoration
ERA	Ecological Risk Assessment
ESH&QA	environmental, safety, health, and quality assurance
FSP	Field Sampling Plan
FTL	field team leader
GFP	gas flow proportional counting
HSO	health and safety officer
IH	industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory (formerly called INEL)
INTEC	Idaho Nuclear Technology and Engineering Center
JSA	job safety analysis
JSS	job site supervisor
LTEM	long-term ecological monitoring
LTS	long-term stewardship
MCP	management control procedure

MSDS	material safety data sheet
NOAA	National Oceanic and Atmospheric Administration
OU	operable unit
PM	project manager
PPE	personal protective equipment
PQL	practical quantitation limit/level
QAPjP	Quality Assurance Project Plan
RCT	radiological control technician
RDX	cyclotrimethylene trinitroamine
ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
SAM	Sampling and Analysis Management
SC	safety coordinator
TNT	trinitrotoluene
TOS	task order statement of work
TPR	technical procedure
TRA	Test Reactor Area
WAG	waste area group
WERF	Waste Experimental Reduction Facility
WGS	Waste Generator Services
WWP	Warm Waste Pond

Long-Term Ecological Monitoring Field Sampling Plan for 2003

1. INTRODUCTION

This Field Sampling Plan (FSP) was prepared for the Long-Term Ecological Monitoring (LTEM) Project of the Environmental Restoration (ER) Program at the Idaho National Engineering and Environmental Laboratory (INEEL). This plan identifies the characterization project activities, including the health and safety requirements necessary to perform the work. This plan was prepared according to the requirements outlined in INEEL Management Control Procedure (MCP)-9439, "Preparation for Environmental Sampling Activities at the INEEL," and MCP-3562, "Hazard Identification, Analysis, and Control of Operational Activities."

1.1 Project Objectives

The objective of the FSP activities is to provide data and guidance for yearly sampling in accordance with the LTEM Plan (INEEL 2003). The LTEM Plan presents the approach for LTEM at the INEEL. The LTEM Plan approach is based on the results of the Operable Unit (OU) 10-04 Ecological Risk Assessment (ERA) presented in the Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups (WAGs) 6 and 10 OU 10-04 (DOE-ID 2001). The OU 10-04 ERA was an INEEL-wide assessment with the primary purpose of evaluating risk to ecological receptors from contamination released to the environment from INEEL activities as identified by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The LTEM plan was developed to meet the requirement of implementing Site-wide ecological monitoring set forth in the 10-04 Record of Decision (ROD).

The LTEM Plan (INEEL 2003) calls for yearly sampling to support baseline contaminant characterization and collection of data in a comprehensive and systematic approach. Yearly sampling will provide the information needed to support the decision statements for long-term monitoring at the INEEL.

Two main on-Site areas will be characterized in 2003: Ordnance Group #1 and Test Reactor Area (TRA). Ordnance Group #1 contains several ordnance sites that were identified as having a potential risk to ecological receptors from munitions contamination. Several TRA sites have been identified as potential sites of concern to ecological receptors from radionuclide contamination and, to a lesser extent, metals. Contaminants in the soil may be released from these source areas and may be transported into the environment along various pathways, including surface runoff, subsurface infiltration, airborne dust migration, biotic intrusion, and uptake by biota. Sample data focused on ecological receptors are very limited for these sites.

Two terrestrial reference areas will be characterized in 2003. The terrestrial reference areas will match the geological, hydrological, and ecological conditions at TRA and Ordnance Group #1 to the greatest extent possible. Reference area data serve to provide a baseline of natural, ambient conditions for all media in the absence of site-related contaminant impacts.

Since TRA has several pond areas that may be of concern, the ponds and an associated aquatic reference area will also be evaluated. Open water on the INEEL attracts wildlife, such as waterfowl and swallows. The waterfowl at the TRA waste ponds are sampled and discussed in a yearly status report (for example, the *INEEL Off-site Environmental Surveillance Report*). Information in the status report will be used to characterize the exposure to waterfowl. Maximum exposure to receptors from the pond will be evaluated, possibly using swallows or another receptor as indicators. Swallows were collected as indicators for characterization of the TRA Warm Waste Ponds (WWPs) during the 1970s (Millard, Whicker, and Markham 1990). However, sampling of aquatic sites will not be included in this FSP, but will be performed during a future sampling season under the LTEM Plan.

Collection of small mammals will provide an indication of possible exposure of reptiles to contamination in the soil. Population information for reptiles will be collected consistent with the direction given in the OU 10-04 ROD. Collection will occur during future field seasons under the LTEM Plan, and university experts will assist in the design of this project.

This FSP is implemented in accordance with the latest revision of the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 2002b). The quality assurance project plan (QAPjP) and this FSP constitute the sampling and analysis plan for the LTEM 2003 sampling effort (Appendix A contains the sample and analysis plan tables). This document governs all work performed by INEEL employees, subcontractors, and employees of other companies or U.S. Department of Energy (DOE) laboratories during sampling.

1.2 Site Description

The INEEL occupies 2,305 km^2 (890 mi^2) of the northwestern portion of the Eastern Snake River Plain (see Figure 1-1). Figure 1-2 shows the general location of TRA and Ordnance Group #1. Figure 1-3 shows the general locations of the terrestrial reference areas. The Snake River Plain is about 97 km (60 mi) wide and over 600 km (370 mi) long. A few buttes exist on the INEEL, but most of the land is flat to gently rolling high-desert terrain that lies about 5,000 ft above sea level.

The INEEL is a semi-arid desert with a low mean annual precipitation (< 22 cm [9 in.]) and large daily and seasonal temperature fluctuations. In the winter, the temperature may not rise above freezing, and topsoils usually remain frozen from mid to late November through early March. Snow cover typically persists for at least 2 to 3 months. During the summer, low humidity and clear skies result in relatively high maximum temperatures of 30 to 35°C (85 to 95°F) and night temperatures that drop to below 10°C (50°F).

The isolated INEEL facilities are separated from each other by vast, primarily undeveloped, sagebrush flats interrupted by basalt outcrops. Because its borders are protected, the INEEL is a refuge for plants and wildlife, and its core is arguably the largest area of undeveloped and ungrazed sagebrush steppe in the Intermountain West, outside of national parks. In addition, due to its location at the mouth of several mountain valleys, large numbers of raptors and mammals migrate onto the Site. During some years, raptors, pronghorn, and sage grouse winter on the INEEL.

1.2.1 Ordnance Group #1

During large and small detonation tests in the 1940s, land mines, smokeless powder, and bombs placed in explosives storage bunkers or outside on the ground surface were detonated to determine the effects on collocated bunkers and facilities. Because of these activities, many projectiles (explosive and inert), explosive residues, and pieces of explosives still exist on INEEL land. Three locations with trinitrotoluene (TNT) and cyclomethylene trinitramine (RDX) residues have been chosen for ecological characterization. These locations are:

- ORD-8, National Oceanic and Atmospheric Administration (NOAA)
- ORD-10, Fire Station II Zone and Range Fire Burn Area
- ORD-15, Experimental Field Station.

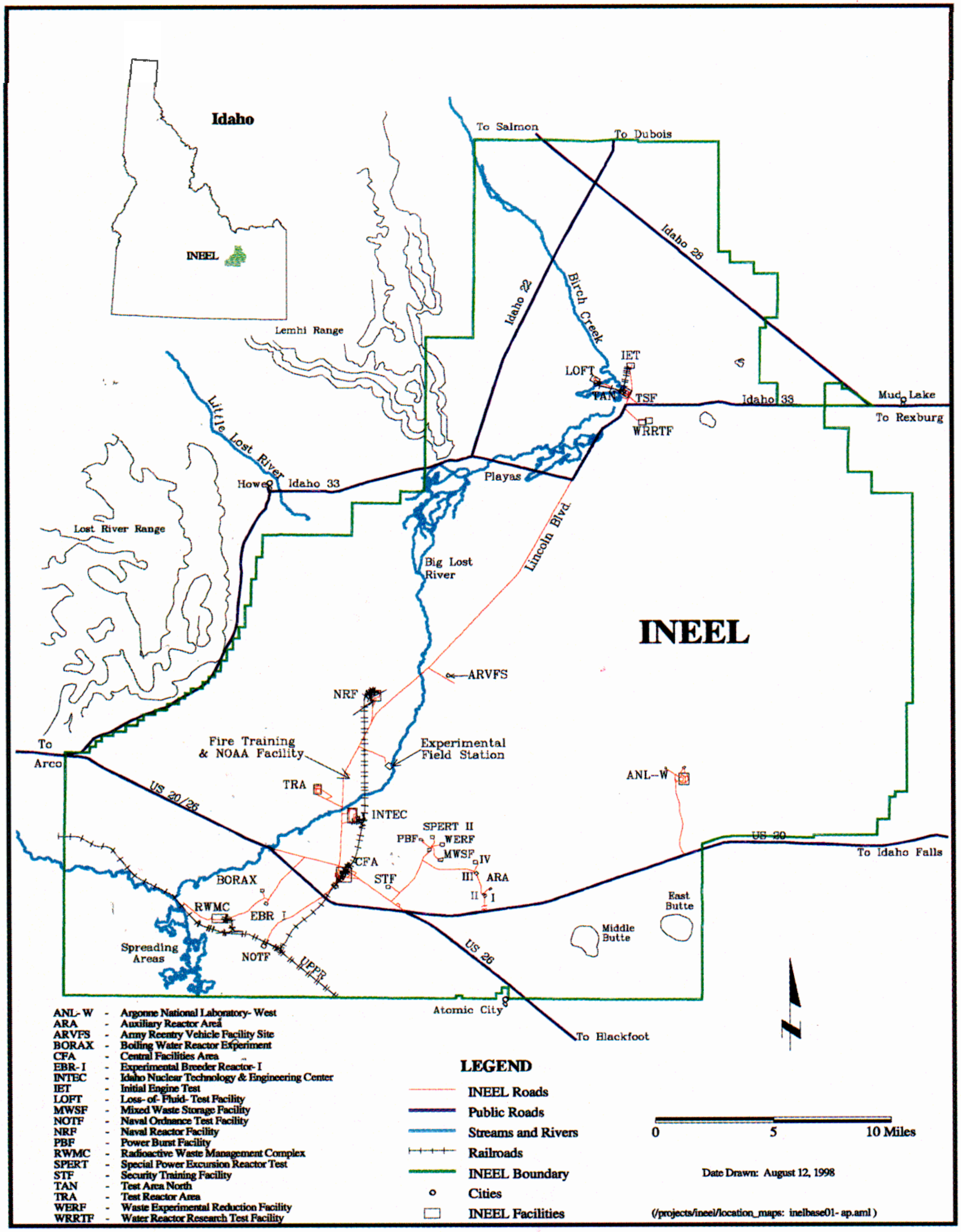


Figure 1-1. Map of the INEEL showing the location of major facilities.

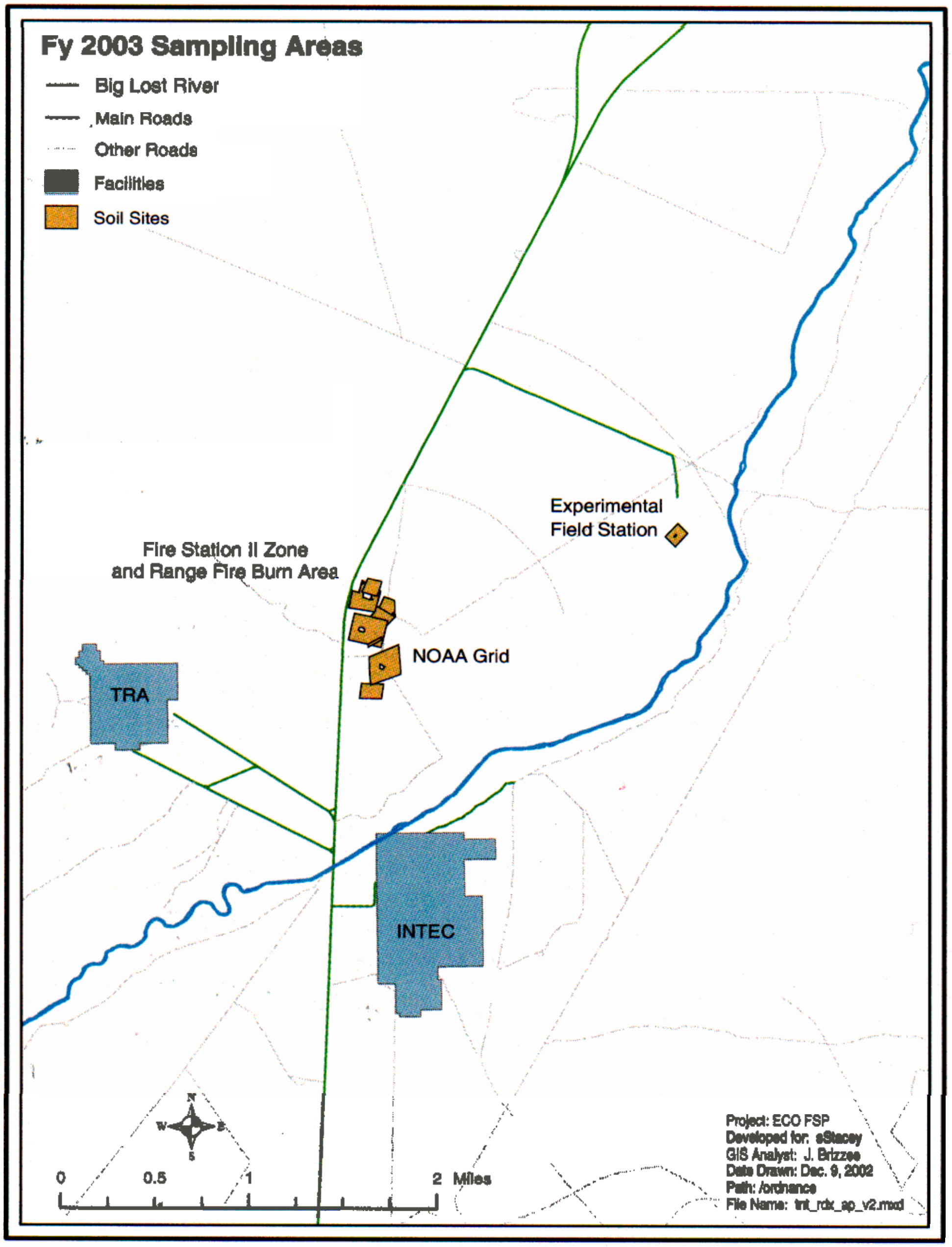


Figure 1-2. Map showing the location of TRA and Ordnance Group #1 (Fire Station II Zone and Range Fire Burn Area, NOAA Grid, and Experimental Field Station).

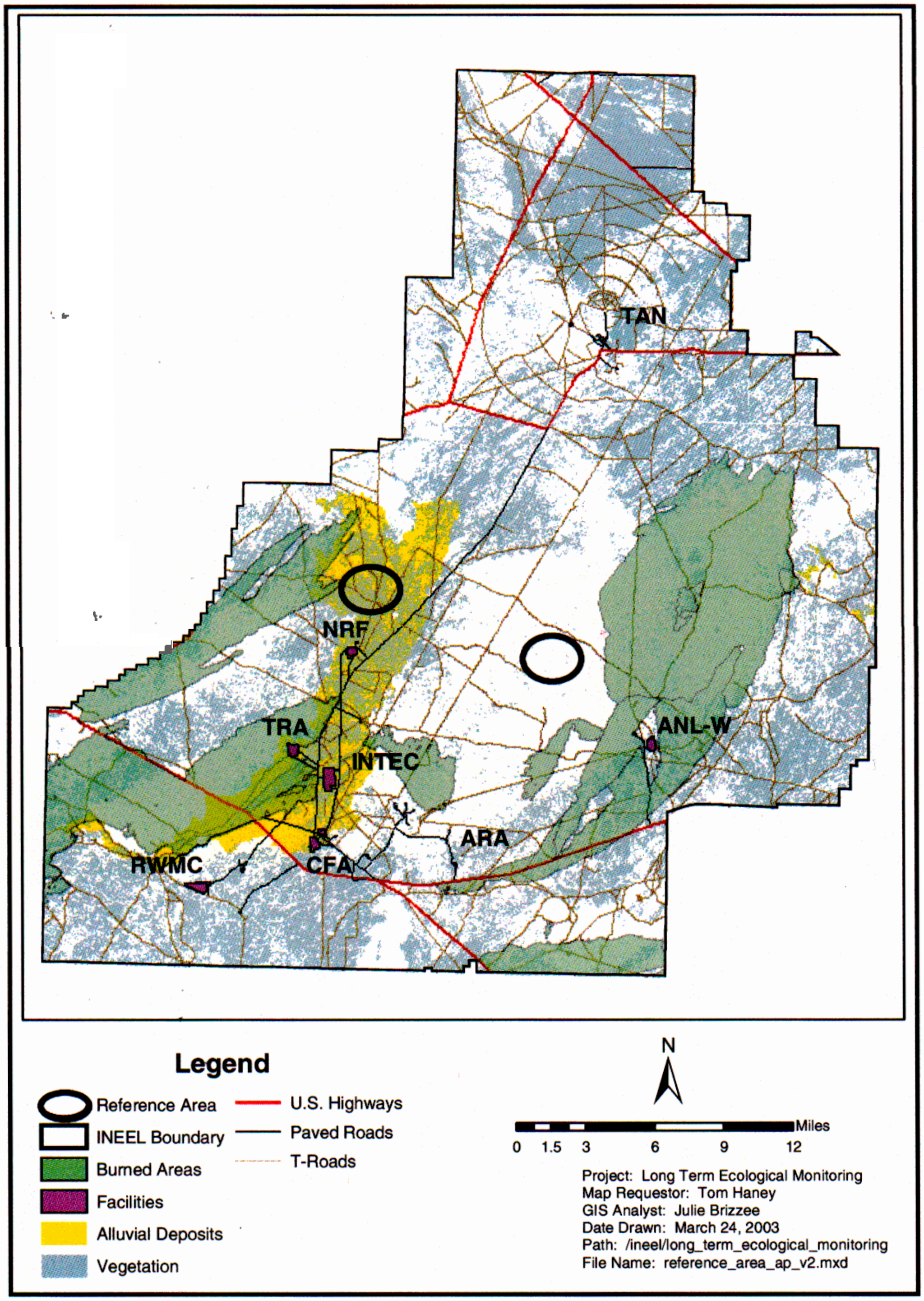


Figure 1-3. Map showing the locations for the terrestrial reference area selection.

These three ordnance areas have been grouped according to location and contaminant type to create Ordnance Group #1 for evaluation during LTEM.

1.2.1.1 *Environmental Setting.* The sites within Ordnance Group #1 are located approximately 1.6 km (1 mi) from TRA and the Idaho Nuclear Technology and Engineering Center (INTEC), and approximately two miles from the Naval Reactors Facility (Figure 1-2). The overall size of the larger areas is approximately 500 × 1100 m (550 × 1200 yd) and the smaller area is approximately 150 × 150 m (165 × 165 yd). The aspect is generally flat, with the terrain gradually sloping toward the Big Lost River channel. All the sites in Ordnance Group #1 are near the Big Lost River, an intermittent stream that flows only during wetter years and infiltrates the ground at the INEEL at the Big Lost River sinks.

Vegetation in the ordnance areas predominantly consists of sagebrush (*Artemisia spp.*) and crested wheatgrass (*Agropyron cristatum*), with lesser amounts of other shrubs, grasses, and forbs. The surrounding areas provide relatively continuous stretches of good sagebrush habitat.

1.2.1.2 *Contaminants of Potential Concern.* The contaminants of potential concern (COPCs) for Ordnance Group #1 include TNT, RDX, and several degradation products (the most common are listed in Table 1-1). In addition to these, radionuclides and metals are considered COPCs for Ordnance Group #1, which is located relatively near facilities with known releases of radionuclides and metals. For ecological receptors, the data collected will help determine if significant adverse effects to plants and wildlife are occurring. See Table 1-1 for the overall list of COPCs.

1.2.1.3 *Probable Transport Pathways.* The explosive residues can potentially affect animals through skin contact, inhalation, and ingestion. Ecological receptors, like deer mice (*Peromyscus maniculatus*) or cottontails (*Sylvilagus spp.*), are most likely to contact explosive residues during feeding, tracking, and burrowing. Animals could ingest soil-adsorbed residues during preening or grooming, or they could ingest contaminated surface water in wet weather. During high winds, animals could inhale and ingest particulates. Ingestion could also occur if animals consume plants covered in dust. In addition, plants rooting in contaminated soil could bioaccumulate contaminants. Soil invertebrates could potentially bioaccumulate explosive compounds and pass these residues on to higher trophic levels that feed upon them.

1.2.2 TRA

The TRA is located in the southwest portion of the INEEL, approximately 7.9 km (4.9 mi) northwest of Central Facilities Area (CFA). Established in 1950, three major nuclear reactors have been constructed at TRA for research and testing. A double security fence surrounds TRA (see Figure 1-4), and more than 73 buildings and 56 structures are located inside the fence. Historical waste sites outside the fence include four pond areas: the Chemical Waste Pond, the Sewage Leach Pond, the WWP, the Cold Waste Pond, and one waste storage area (the North Storage Area [TRA-664]). In addition to these sites, releases from spills and underground storage tanks have occurred at TRA. Investigated and remediated for human health risk under CERCLA, when necessary, residual contaminant concentrations in these locations are considered acceptable for human health risk, but may be of concern for ecological receptors.

Today, TRA still generates waste that, although extracted and treated, contains low-level radioactive and chemical contaminants. These wastes are disposed of in evaporation ponds (completed in 1995) outside the fence. The liquid wastes in these ponds may also be of concern for ecological receptors. Sampling to characterize aquatic receptors at the areas of concern (AOCs) will be performed in future sampling seasons.

Table 1-1. LTEM analytes, required quantitation levels, and analytical method.

Contaminant Type	Contaminant Name	Estimated Background UTL[c]	PQL[e] Required	Analytical Method
Inorganics: (Metals)[a]	Arsenic (As)	5.8 mg/kg	1 mg/kg	SW846 6010A
	Beryllium (Be)	1.8 mg/kg	1 mg/kg	—
	Cadmium (Cd)	2.2 mg/kg	1 mg/kg	—
	Chromium (Cr)	33 mg/kg	5 mg/kg	—
	Lead (Pb)	17 mg/kg	3 mg/kg	—
	Mercury (Hg)	0.05 mg/kg	0.01 mg/kg	—
	Zinc (Zn)	150 mg/kg	10 mg/kg	—
Explosives:[b]	TNT	—[d]	0.5 mg/kg	SW846 8330
	RDX	—[d]	0.5 mg/kg	—
	HMX	—[d]	0.5 mg/kg	—
	2,4 Dinitrotoluene	—[d]	0.5 mg/kg	—
	2,6 Dinitrotoluene	—[d]	0.5 mg/kg	—
	2-amino-4,6 Dinitrotoluene	—[d]	0.5 mg/kg	—
	4-amino-2,6 Dinitrotoluene	—[d]	0.5 mg/kg	—
Radionuclides:[a]	Americium-241 (Am-241)	0.011 pCi/g	—	Alpha spectroscopy
	Gamma emitters	0.82 pCi/g	0.1 pCi/g	Gamma spectrometry
	Pu-238	0.005 pCi/g	—	Alpha spectroscopy
	Pu-239/240	0.1 pCi/g	—	Alpha spectroscopy
	Strontium-90 (Sr-90)	0.5 pCi/g	1 pCi/g	GFP[f]
	Uranium (U-234)	1.4 pCi/g	—	Alpha spectroscopy
	U-238	1.4	—	Alpha spectroscopy

a. Ordnance Group #1, TRA, and reference areas.
b. Ordnance Group #1 and reference areas.
c. UTL = upper tolerance limit.
d. any detection of these compounds is considered above background.
e. practical quantitation limit/level (PQL) based on a percentage of the action levels.
f. GFP = Gas flow proportional counting.

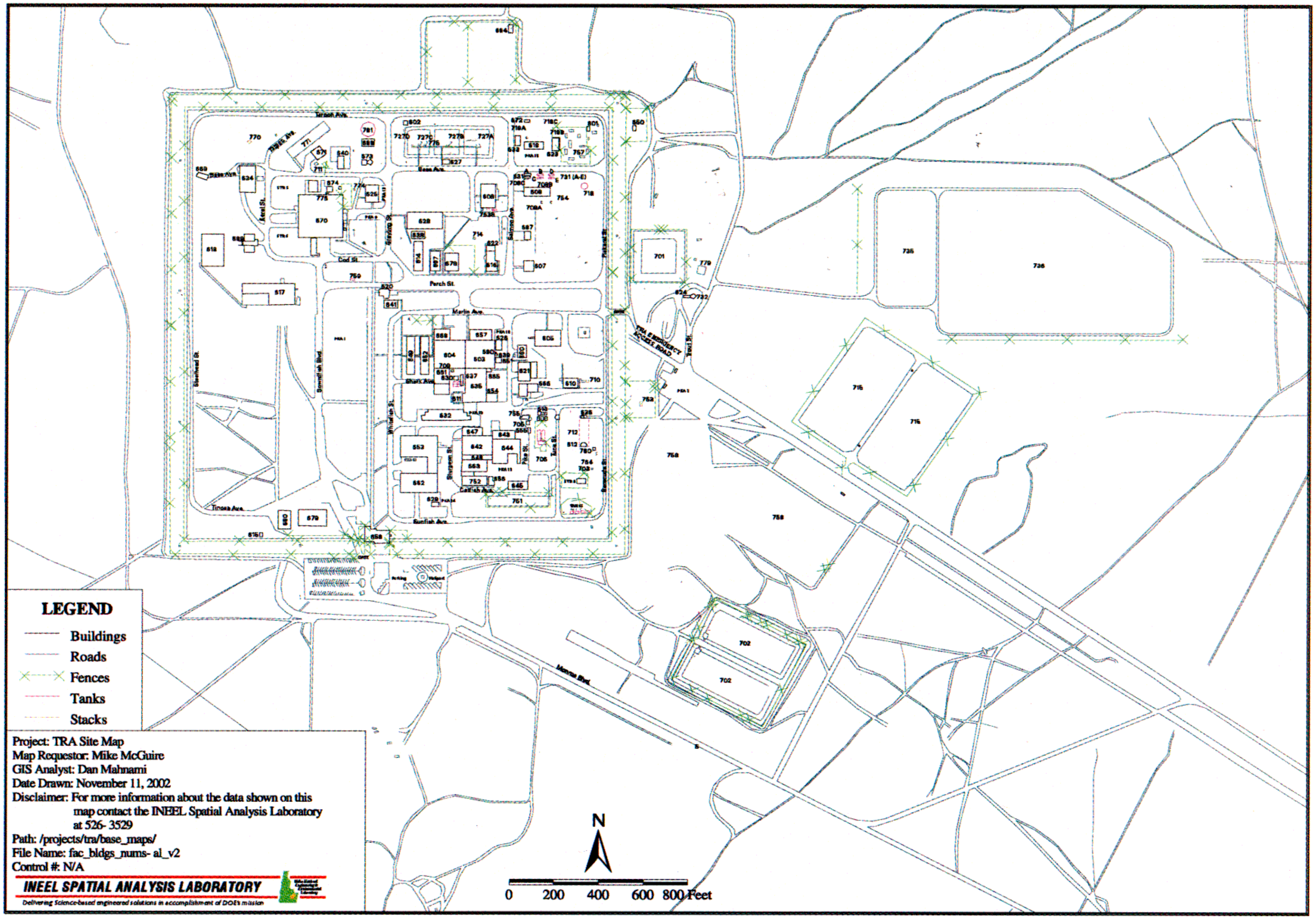


Figure 1-4. TRA facility and ponds.

1.2.2.1 Environmental Setting. Situated in the flat, alluvial soils of the Big Lost River floodplain, TRA approaches 75 acres (30 ha) in size. Vegetation surrounding TRA consists predominantly of sagebrush (*Artemisia spp*) and crested wheatgrass (*Agropyron cristatum*), with lesser amounts of other shrubs, grasses, and forbs. The surrounding area provides relatively continuous stretches of good sagebrush habitat. Site visits indicated that small mammals find shelter under the riprap boulders placed on top of TRA WWPs. Evidence of small mammal activity was observed along the fence surrounding TRA. Many small and large mammal tracks and scat were also observed in the outlying areas.

1.2.2.2 COPCs. Previous investigations at TRA indicate that radionuclides (i.e., Ag-108_m, Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Sr-90, Am-241, Pu-238, Pu-239/240, Sr-90, U-234, and U-238) are the primary COPCs for ecological receptors, followed by heavy metals (arsenic, beryllium, cadmium, chromium, and mercury). Table 1-1 lists the overall COPCs. Note that Ag-108_m, Co-60, Cs-134, Cs-137, Eu-152, and Eu-154 are gamma-emitters and, if present, will be detected in the gamma spectroscopy analysis.

1.2.2.3 Probable Transport Pathways. Transport of contaminants from buried materials and wastes at TRA would be due primarily to burrowing activities by small mammals. Some exposure to receptors is also possible by direct contact with radionuclide contaminated surface soils or with contaminated water in surface ponds. If birds or small mammals access these areas, additional exposures might result from dermal absorption and ingestion of contaminants in surface water or sediments. Some birds, like swallows, use the mud to build nests. Fledglings and adult swallows feed on adult life stages of benthic invertebrates that could have taken up contaminants from sediment or surface water within the ponds.

1.2.3 Reference Areas

The locations for the reference areas were selected by considering soil type, disturbance, and habitat type because this type of information is critical to interpret the population data. The reference areas are outside of the prevailing wind pattern that could introduce site-related contaminants (Figure 1-3). However, because large fires have disturbed the habitat, care has been taken to avoid burned areas. Sagebrush steppe dominates the potentially impacted areas, so the habitat type matches the potentially impacted areas to the greatest extent possible. Figure 1-3 shows the locations of the reference areas relative to the facilities and burned areas. The reference areas were selected from the proposed region where these three variables most closely match the WAG sites. Field crews will visit the reference areas in the spring of 2003 to choose suitable sampling locations.

1.3 Scope

LTEM sampling will occur as presented in the LTEM Plan (INEEL 2003). Different locations will be sampled and different activities will take place each year. Efforts will be directed at sampling for levels of contamination in the selected media and detecting possible effects. To validate the OU 10-04 ERA assumption of no migration of contamination off the areas of concern and to establish a baseline, the levels of contamination in soil, deer mice, and plants will be determined. In addition, earthworms from the laboratory bioassay will be evaluated for uptake of contaminants as a cost-effective measure of predicting the role of INEEL invertebrates in the food web transfer of various contaminants. The following activities are part of the 2003 scope:

- Evaluating effects data for soil fauna, plants, mammals, and avian receptors at the areas of concern. Appendix B and TPR-145, "Biotic and Proximal Soil Sampling," present the sampling procedures used for collection of the analytical samples and the effects samples at each AOC.

- Obtaining necessary prejob paperwork, including safe work permits, scientific collection or trapping permits, and radiological work permits.
- Complying with the requirements of MCP-2725, "Field Work at the INEEL."
- Ensuring all personnel are trained.
- Ensuring all sampling equipment, forms, labels, and bottles are available.
- Obtaining vehicle support.
- Obtaining all laboratory support.
- Performing sampling in the spring and early summer of 2003 as described in the Appendix B overview.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

The following sections contain descriptions of the personnel associated with this FSP. Table 2-1 contains personnel assignments and contact information. These responsibilities may change throughout the sampling effort and a logbook entry will be made to show the name of the individual performing the function.

Table 2-1. Proposed personnel and job assignments.

Assignment	Name	Phone
Technical Lead	Robin VanHorn	208-526-1650
Field Team Leaders (FTLs)	Thomas Haney/Robin VanHorn/	208-526-9407/208-526-1650
Health and Safety Officer (HSO)	TBD	TBD

2.1 Technical Lead/Work Package Manager

The technical lead ensures all activities conducted during the project comply with INEEL MCPs and program requirements documents, as well as all applicable requirements of the Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), DOE, U.S. Department of Transportation, and State of Idaho. The technical lead coordinates all document preparation, field and laboratory activities, data evaluation, risk assessment, dose assessment, and design activities. The work package manager is responsible for the overall work scope, schedule, and budget.

The technical lead is responsible for field activities and for all personnel, including craft personnel, assigned to work at the project location. The technical lead serves as the interface between operations and project personnel and will work closely with the sampling team at the job site to ensure the objectives of the project are accomplished in a safe and efficient manner. The technical lead works with all other identified project personnel to accomplish day-to-day operations, identify and obtain additional resources needed at the job site, and interact with environmental, safety, health, and quality assurance (ESH&QA) oversight personnel on matters regarding health and safety.

2.2 Sampling Coordinator

The INEEL sampling coordinator is responsible for coordinating sampling activities across the INEEL site. Upon notification by the project manager (PM), the sampling coordinator is responsible for scheduling the necessary resources and personnel to complete the sampling task.

2.3 FTL/Job Site Supervisor

The FTL or job site supervisor (JSS) is the INEEL representative at the job site with the responsibility for the safe and successful collection of samples. The FTL/JSS acts as the team leader and works with INEEL facility personnel, ESH&QA personnel, and the field sampling team to manage field sampling operations and to execute the characterization plan. The FTL/JSS enforces site control, documents activities, and may conduct the daily safety briefings at the start of the shift. Health and safety issues may be brought to the attention of the FTL.

If the FTL/JSS leaves the job site during sampling operations, an alternate is appointed to act as the FTL/JSS. The identity of the acting FTL/JSS is conveyed to sampling personnel at the sampling location, recorded in the logbook, and communicated to the facility representative, when appropriate.

2.4 Health and Safety Officer

The Health and Safety Officer (HSO) is located at the work site and serves as the primary contact for health and safety issues. The HSO assists the FTL in all aspects of health and safety, including complying with the enhanced work planning process. The HSO is authorized to stop work at the site if any operation threatens workers or public health and safety. The HSO may be assigned other responsibilities, as stated in other sections of the project job safety analysis (JSA), as long as they do not interfere with the primary responsibilities stated here. The HSO is authorized to verify compliance with the JSA, conduct inspections, monitor decontamination procedures, and require and monitor corrective actions, as appropriate. Other ESH&QA personnel at the work site (i.e., safety coordinator [SC], industrial hygienist [IH], radiological control technician [RCT], radiological engineer, environmental compliance coordinator, and facility representative[s]) may support the HSO, as necessary.

The HSO, or alternate, must be qualified (per OSHA definition) to recognize and evaluate hazards and is given authority to take or direct actions to ensure that workers are protected. While the HSO may also be the IH, SC, or, in some cases, the FTL (depending on the hazards, complexity, and size of the activity involved, and with concurrence from the ER ESH&QA manager) at the work site, other task-site responsibilities must not conflict, philosophically or in terms of significant added volume of work, with the role of the HSO at the work site.

If it is necessary for the HSO to leave the work site, an alternate will be appointed by the HSO to fulfill this role. The identity of the acting HSO will be recorded in the FTL logbook, and work-site personnel will be notified.

2.5 Samplers

Samplers include all task-site personnel assigned to the characterization project to obtain samples for analytical purposes. All samplers, including INEEL, DOE, and subcontractor personnel, must understand and comply with the requirements of this document and other applicable documentation. Sampling personnel are briefed at the start of each shift by the FTL/JSS regarding the tasks to be performed and the applicable health and safety requirements. During the prejob briefing, work tasks, associated hazards, engineering and administrative controls, required personal protective equipment (PPE), work control documents, and radiological and emergency conditions are discussed.

Samplers are responsible for identifying any potentially unsafe situation or condition to the FTL/JSS and applicable ESH&QA representatives for corrective action. If it is perceived that an unsafe condition poses imminent danger, sampling personnel are authorized to stop work immediately, and notify the FTL/JSS of the unsafe condition.

2.6 Waste Generator Services Waste Technical Specialist

The INEEL Waste Generator Services (WGS) waste technical specialist ensures that the disposition of waste material complies with approved INEEL waste management procedures. WGS personnel have the responsibility to help solve waste management issues at the task site. WGS personnel also prepare the appropriate documentation for waste disposal and make the proper notifications, as required. All wastes are disposed of using approved INEEL procedures in accordance with INEEL PRD-5030, "Environmental Requirements for Facilities, Processes, Materials and Equipment, Idaho National Engineering and Environmental Laboratory."

2.7 Sampling and Analysis Management Technical Representative

The Sampling and Analysis Management (SAM) technical representative is responsible for helping define the analytical project, generating the sampling and analysis plan table, and generating and issuing sample labels. The SAM representative determines the laboratory that will provide analytical services based on established policies and contracts, and prepares the task order statement of work. The SAM representative also tracks analytical progress and performs cursory review of the final data packages. The SAM representative obtains independent validation of the data results as project requirements dictate.

2.8 ESH&QA Support

ESH&QA personnel are assigned to the job site to provide resources and expertise to resolve ESH&QA issues. Personnel assigned to provide ESH&QA support must be qualified to recognize and evaluate hazards, environmental concerns, or quality issues according to his or her expertise and are given the authority to take or direct immediate actions to ensure compliance and protection. ESH&QA personnel assess and ensure compliance with applicable INEEL procedures, including this document.

Radiological control support personnel are the source for information and guidance on radiological hazards at the job site. Radiological support personnel may include the radiological control supervisor, RCTs, and radiological engineers. The RCT is responsible for surveying the task site, equipment, and samples, and providing guidance for work activities in accordance with PRD-183, "Radiation Protection - INEEL Radiological Control Manual." The radiological engineer provides information and guidance relative to the evaluation and control of radioactive hazards at the job site, including performing radiation exposure estimates and as low as reasonably achievable evaluations, identifying the type(s) of radiological monitoring equipment necessary for the work, and advising personnel of changes in monitoring and PPE.

2.9 Data Storage Administrator

The data storage administrator is responsible for the maintenance of data records. All data will be maintained in accordance with TPR-6240, "Transferring Integrated Environmental Data Management System Data to the Environmental Data Warehouse."

3. DATA QUALITY OBJECTIVES

The EPA developed the Data Quality Objectives (DQOs) process to ensure the type, quantity, and quality of data used in decision-making are appropriate for the intended application. The DQOs presented in this FSP are consistent with, but not identical to, those presented in the LTEM Plan. These DQOs correspond to the field sampling activities planned for 2003 whereas the LTEM Plan has a broader long-term focus. The DQOs for FY 2003 are summarized in Table 3-1.

The DQO process includes seven steps, each having specific outputs. Each of the following subsections corresponds to a step in the DQO process, and the output for each step is provided as appropriate. The outputs of the DQO process can be used to develop a statistical sampling design and to effectively plan field investigations that can stand up to rigorous review. The DQOs specific to laboratory precision and accuracy are presented in the QAPjP (DOE-ID 2002b).

3.1 Step 1—State the Problem

The first step in the DQO process is to clearly state the problem. As discussed in the LTEM Plan (INEEL 2003), the problem is that residual contamination will remain after remediation at the INEEL under CERCLA. LTEM will be implemented at the INEEL to verify that the remedial objectives of each INEEL remedial action are maintained for ecological receptors and to determine if the long-term sitewide ecological impact of the contamination left in place is within acceptable limits. The overall project objective of LTEM is to develop an integrated approach to ensure continued protection of INEEL ecological resources; the objective of this FSP is to collect sufficient data to meet the objectives of the LTEM Plan.

The FSP-specific DQOs apply to the data collection activities at each AOC being sampled under the LTEM Plan (INEEL 2003). The objective of this sampling activity is to determine if contaminant concentrations in each AOC are elevated in comparison with background and to determine if effects are evident. If the results of this sampling activity show both elevated concentrations and effects, then more associated studies may be completed that will focus on detecting additional effects, possible biomarkers, and indicators as discussed in the LTEM Plan (INEEL 2003). The data collected within the scope of this FSP in 2003 at TRA, Ordnance Area #1, and the reference areas will become part of a database of information collected from various sites for many years. The results of the 2003 sampling activity will also be used to direct associated studies focused on the detection of effects and possible biomarkers and indicators as discussed in the LTEM Plan (INEEL 2003).

Several secondary objectives may be achieved by the FY 2003 sampling design, including the identification of trends in contaminant migration from the AOCs.

3.2 Step 2—Identify the Decision

Identifying the decision is primarily a matter of stating what will be done. The decision statement (DS) pertinent to the 2003 FSP is presented below.

3.2.1 Decision Statement

Determine if site-related contaminant concentrations, in either biotic or abiotic media, are elevated relative to the reference areas and if effects are apparent.

Table 3-1. DQOs for 2003.

Problem Statement	The objective of sampling at each AOC identified in the LTEM Plan (INEEL 2003) is to evaluate the present level of contamination and to determine if any effects are evident at each AOC as compared to the reference areas.
DS	**DS-1:** Determine if the levels of site-related contaminants, in either biotic or abiotic media, are elevated relative to the reference areas and if effects are apparent. ***AA-1:*** *Site-related contaminants are elevated and effects are evident relative to the reference areas. Evaluate any correlation or association between contaminants and effects to determine the need for additional associated studies as discussed in the LTEM Plan (INEEL 2003).* ***AA-2:*** *Site-related contaminants are elevated, but no effects are apparent relative to the reference areas. Evaluate the need for additional associated studies as discussed in the LTEM Plan (INEEL 2003) to detect effects based on those contaminants identified as elevated.* ***AA-3:*** *Site-related contaminants are not elevated, but effects are evident relative to the reference areas. Evaluate if additional contaminants are present to identify more sampling requirements.* ***AA-4:*** *Site-related contaminants are not elevated and no effects are evident relative to the reference areas. Continue monitoring at an appropriate level for trending, to ensure the remedy remains ecologically protective, and to support five-year reviews.*
Inputs to the Decision	Characterization of contaminant concentrations: • contaminant concentrations in soils collocated with vegetation • contaminant concentrations in crested wheatgrass and sagebrush • contaminant concentrations in deer mice collocated with soil and vegetation samples. Characterization of effects: • vegetation community structure, plant bioassay • invertebrate community structure, invertebrate bioassay • mammal community structure, organ and body weights, histopathology, genetic analysis • avian community structure • soil, physical and nutrient, characteristics.
Study Area Boundary	Areas to be sampled during FY 2003 include TRA, Ordnance Area #1, and the reference areas. A 100 × 100 m (110 × 110 yd) grid consisting of 100-m^2 (120-yd^2) cells will be placed over the areas of known or suspected contamination. To ensure distribution of cell allotments, subareas will be delineated in the areas of highest known contamination. Using a stratified random sampling approach, ten cells (i.e., plots) will be selected from this grid based upon apportioning samples to the subareas by areal extent. Sampling will be conducted in each plot so that samples are temporally and spatially collocated. Soil, plant, and small mammal samples will be collected from all locations.
Decision Rules	If analyte concentrations in any media exceed those at the reference areas, then determine if a correlation exists between contaminants and effects to determine the need for additional associated studies as discussed in the LTEM Plan (INEEL 2003). If site-related contaminants are elevated, but no effects are apparent relative to the reference areas, then evaluate the need for additional associated studies, as discussed in the LTEM Plan (INEEL 2003), to detect effects based on those contaminants identified as elevated. If site-related contaminants are not elevated, but effects are evident relative to the reference areas, then evaluate if additional contaminants may be present to identify additional sampling requirements. No further sampling will be performed if effects are related to physical disturbance, such as soil compaction or removal of topsoil. If site-related contaminants are not elevated and no effects are evident relative to the reference areas, then further sampling (for monitoring or otherwise) will not be performed.

Table 3-1. (continued).

Specify Tolerable Limits on Decision Errors	Analyte concentrations can range from below detection limits to well above reference area concentrations. The study design is based on professional judgment, and preset limits on the decision error are not applicable as the sample size is fixed at ten random locations. Statistics will be applied and trends will be evaluated. Error analysis will be carried out when feasible.
Optimize the Sampling Design	The sampling design has been optimized to focus on the areas most likely to be impacted by sources of contamination. Environmental concentrations are likely to be higher, closer to the facilities. If elevated concentrations in various media are not found close to the facility, it is unlikely they would be found farther away.

3.2.2 Alternative Actions

Four possible alternative actions (AAs) could stem from the outcome of the DS for FY 2003 sampling.

AA-1: Site-related contaminants are elevated and effects are evident relative to the reference areas. Evaluate if any correlation or association exists between contaminants and effects to determine the need for additional associated studies as discussed in the LTEM Plan (INEEL 2003).

As sampling progresses, indicators of bioaccumulation through the food web may indicate sampling of higher trophic level organisms to obtain verification of contaminant movement through the food web and to evaluate possible effects to these organisms. Higher trophic species include species such as a badger and coyote. This type of information would be collected to support the larger objectives identified in the LTEM Plan (INEEL 2003).

AA-2: Site-related contaminants are elevated, but no effects are apparent relative to the reference areas. Evaluate the need for additional associated studies as discussed in the LTEM Plan (INEEL 2003) to detect effects based on those contaminants identified as elevated.

Sampling for effects may be very contaminant-specific. If no effects are indicated using the approach documented in this FSP, then more focused sampling (i.e., associated studies) may be needed.

AA-3: Site-related contaminants are not elevated, but effects are evident relative to the reference areas. Evaluate if additional contaminants are present to identify more sampling requirements. No further sampling will be performed if effects are related to physical disturbance, such as soil compaction or removal of topsoil, as determined by visual observation.

AA-4: Site-related contaminants are not elevated and no effects are evident relative to the reference areas. Further sampling (for monitoring or otherwise) will not be performed unless indicated by the LTEM Plan assessment. These data will go forward to be assessed with the other sites during the multi-year sampling effort.

3.3 Step 3—Input to the Decision

The objective of DQO Step 3 is to identify the information that will be required to determine the appropriate AA identified in DQO Step 2. The information needed to resolve the DS listed above is the identification and quantitation (minimum, maximum, and average concentrations) of contaminants present in each of the sampling areas or subgroups and the various endpoints effects. The data types to be collected include COPC concentrations in soil, selected vegetation species, and small mammals. In addition, species identification and counts will be recorded for all vegetation collected. These data will also record small mammals trapped and released or sacrificed. Specific inputs include, but are not limited to, the following:

- Soil cation exchange capacity, pH, and total organic carbon
- Contaminant concentrations in soils collocated with vegetation
- Contaminant concentrations in crested wheatgrass and sagebrush
- Contaminant concentrations in deer mice collocated with soil and vegetation samples
- Vegetation community structure, plant bioassay
- Invertebrate community structure, invertebrate bioassay
- Mammal community structure, organ and body weights, histopathology, and genetic analysis
- Avian community structure.

See Appendix B and the LTEM Plan (INEEL 2003) for more specific discussion of these input.

3.4 Step 4—Study Area Boundary

Defining the scale of decision-making is the primary objective of this step in the DQO process. It clearly describes what, when, and where data will be collected during FY 2003 sampling activities. These data include the populations of interest, as well as spatial and geographical boundaries.

3.4.1 Populations of Interest

Two AOCs and one reference area will be evaluated in 2003 under this FSP. At these AOCs, the sampling area will be reduced to those areas with known or suspected contamination. Sampling within these areas of known contamination is designed to optimize the ability to detect contamination and effects. It is acceptable to limit the sampling in this manner because if no effects are observed nearest to the contaminant source, it is unlikely that effects would be observed at farther distances from the source(s) or in areas of lower contamination.

To determine if possible elevated levels of contamination or effects exist in these AOCs, both biotic and abiotic media were selected as indicators. The media selected for sampling should be good indicators and are reasonably easy to collect. As stated in the LTEM Plan and in this document, additional media and species of concern will be selected for collection as data collection proceeds in the coming years. The aquatic species across the INEEL will be collected at sites with an aquatic pathway in a future effort across the AOCs identified in the LTEM Plan (INEEL 2003). Media selected for annual terrestrial yearly sampling at each AOC are discussed below.

3.4.1.1 Flora and Fauna. As discussed in the LTEM Plan (INEEL 2003), the considerations for selecting organisms to be evaluated for monitoring and assessment are abundance (because highly abundant species are more likely to be an important part of the food web), occurrence within the impacted areas (because this will make them available for sampling), and life history (highly exposed species are likely to be more affected than unexposed species). The rationale for each of the selected sampling efforts is discussed below. However, based on the outcome of future sampling, additional species may be identified and evaluated.

3.4.1.2 Animals.
Initially, one animal species, representing major linkages between primary and secondary consumers and higher predators, will be collected for tissue analyses. The animal selected as the most appropriate for sampling in the 2003 FSP was the deer mouse (*Peromyscus maniculatus*). The deer mouse is a major prey item for both secondary and tertiary consumers and is omnivorous, widespread, and relatively easy to collect. This species will be used to represent several important linkages in the food chain.

The soil faunal community will be evaluated under the 2003 FSP. Soil fauna, including nematodes, Collembola, and mites, have been considered useful bioindicators for environmental monitoring programs because of their role in essential ecological functions of soil, including nutrient cycling and decomposition. Microinvertebrates play multiple roles in regulating decomposition through grazing, fragmentation of debris, and excretion. Additionally, decomposition rates can serve as indicators in detecting toxic effects on ecosystem processes. Soil fauna have relatively limited movements, thus they are spatially associated with environmental contaminant levels.

3.4.1.3 Plants.
Plants represent a major linkage in the transfer of soil-borne contaminants to primary consumers and higher trophic levels. Two types of vegetation representing different functional plant types (i.e., shrubs, grasses, and forbs) will be collected for chemical analysis. These species are:

- Sagebrush (*Artemisia tridentata*)
- Crested wheatgrass (*Agropyron cristatum*).

Sagebrush represents the shrub most commonly utilized by INEEL primary consumers, including the pronghorn, sage grouse, black-tailed jackrabbit, Nuttall's cottontail, and the pygmy rabbit. In addition, sagebrush is an important component in the diets of avian and mammalian omnivores and herbivorous insects. Most of the natural vegetation at the INEEL consists of a shrub overstory with an understory of perennial grasses and forbs. The most common shrub present at the Site is the Wyoming big sagebrush (*Artemisia tridentata* subspecies *wyomingensis*). However, basin big sagebrush (*Artemisia tridentata* subspecies *tridentata*) is sometimes dominant or co-dominant with Wyoming big sagebrush on sites having deep soils or accumulations of sand on the surface (Shumar and Anderson 1986). It is difficult to distinguish these two species. It is assumed that uptake by both these subspecies is comparable due to their similarities.

Wheatgrasses (*Agropyron* spp) are most widely used and are significant components in the diets of jackrabbits, cottontails, birds, and small mammals. Crested wheatgrass (*Agropyron cristatum)* is the most commonly identified genus in the dietary studies examined with cheat grass (*Bromus tectorum*) being the second most common. Although crested wheatgrass is an introduced species at the site, it is the most commonly occurring species.

3.4.2 Soil

Soil samples will be collected from the surface and subsurface depth. The surface soil samples will be collected from 0 to 5 cm (0 to 2 in.) and the subsurface will be collected from 5 to 61 cm (2 to 24 in.) or bedrock. The soil samples will consist of composites from locations within the sampling plots that correspond to plants from which vegetation samples are collected. It is anticipated that this drop will concentrate on sampling and analytical efforts on the depth most likely to pose a source of contamination to plant roots, and ingestion/physical exposures for surface dwelling and burrowing animals. Historical data collected at the INEEL includes sampling depths of approximately 5, 10, and 15 cm (2, 4, and 6 in.) and additional data for soil depths up to 3.1 m (10 ft). Soil nutrients and physical characteristics will also be evaluated.

3.4.3 Spatial Boundaries

The three sampling areas for FY 2003 include Ordnance Area #1, TRA, and the reference areas. Spatial boundaries for each AOC are identified in Figures 3-1 through 3-3. These figures present the grids used for plot selection. The grids were placed over the areas of known or suspected contamination identified from site knowledge at each area. The grids will be divided into potentially impacted subareas using professional judgment based on historical information concerning radiological or chemical concentrations in soil or distance to the source area.

The two AOCs identified in the LTEM Plan (INEEL 2003) for sampling during FY 2003 include Ordnance Area #1 (discussed in Section 1.2.1) and TRA (discussed in Section 1.2.2). The location of these areas and associated contaminants of concern are included in these descriptions. The maps showing the locations of the grids indicating the areas of possible elevated contaminant concentrations are presented in Figure 3-1 for TRA and in Figures 3-2 and 3-3 for Ordnance Area #1.

The location for the terrestrial reference areas were selected by considering soil type, disturbance, and habitat type because this type of information is critical to interpret population data. The reference areas are outside of the prevailing wind pattern that could introduce site-related contaminants (Figure 1-3). The habitat types at the reference areas will be matched with the potentially impacted areas to the greatest extent possible. In spring 2003, the field crew will visit the reference areas to select actual sampling locations.

3.5 Step 5—Develop a Decision Rule

Decision rules are "if…then" statements that describe the actions that will be taken in response to the results of data collection. The DS identified in Step 2 of the DQO process has associated decision rules.

The DS in Step 2 requires determination of whether site-related contaminant concentrations (in either biotic or abiotic media) are elevated relative to the reference areas and whether effects are apparent. Various data will be collected in the reference areas and compared with data obtained from AOCs. These data include population/community indicators (e.g., density and biomass), histopathology, and toxicity bioassay data as well as concentrations of contaminants in various media. Accepted comparisons based on data collected will be used for statistical assessment. For example, the maximum or upper 95th confidence limit concentration of each COPC from the AOC will be compared with the reference areas. As discussed in Section 3.2.2, four possible alternatives could stem from the outcome of the FY 2003 sampling.

If site-related contaminants are elevated and effects are evident relative to the reference areas, then the data will be evaluated to detect any correlation or association existing between contaminants and effects to determine the need for additional associated studies as discussed in the LTEM Plan (INEEL 2003).

If site-related contaminants are elevated, but no effects are apparent relative to the reference areas, then the need for additional associated studies as discussed in the LTEM Plan (INEEL 2003) is evaluated to detect effects based on those contaminants identified as elevated.

If site-related contaminants are not elevated, but effects are evident relative to the reference areas, then evaluate whether additional contaminants are present and necessitate additional sampling requirements.

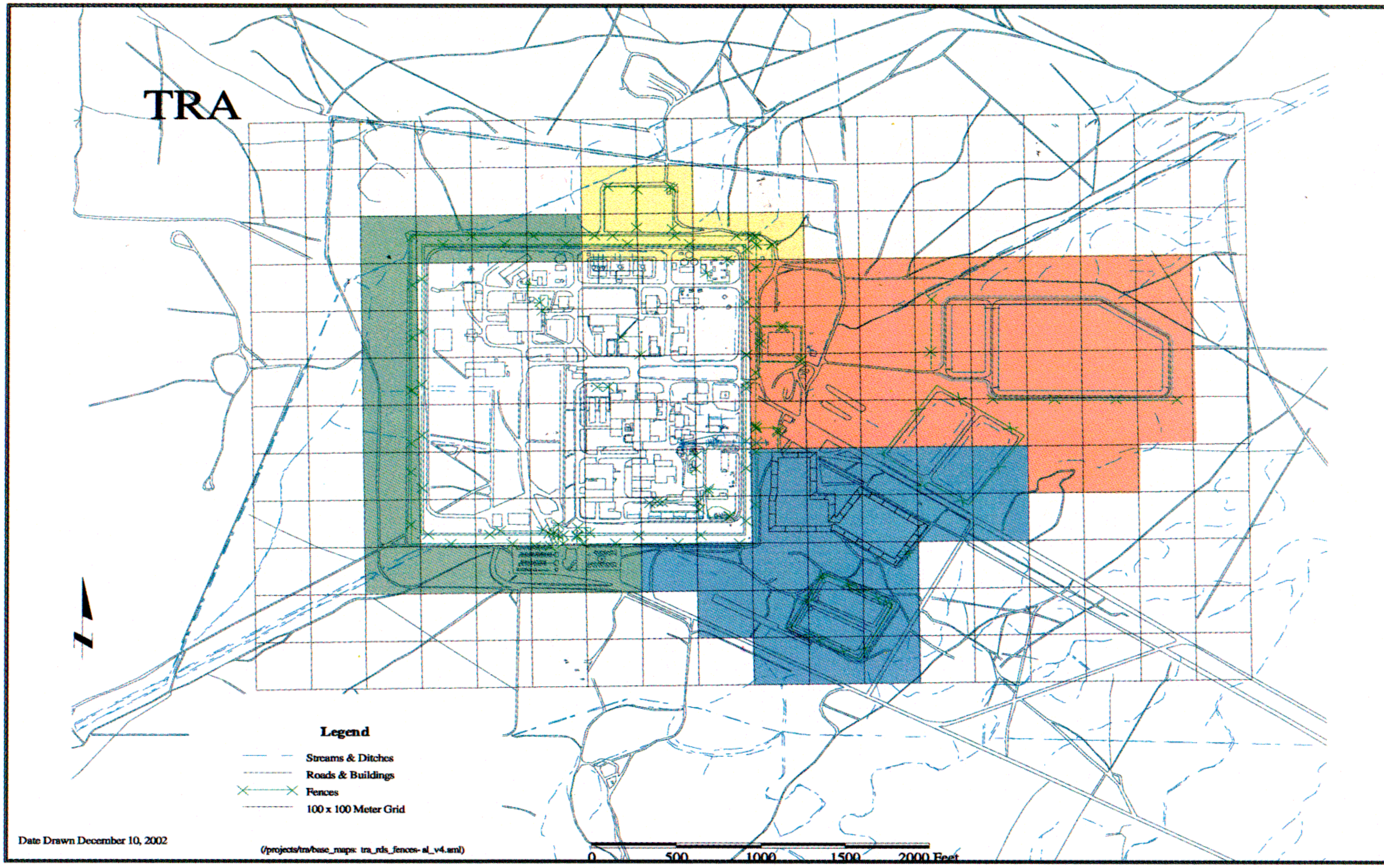
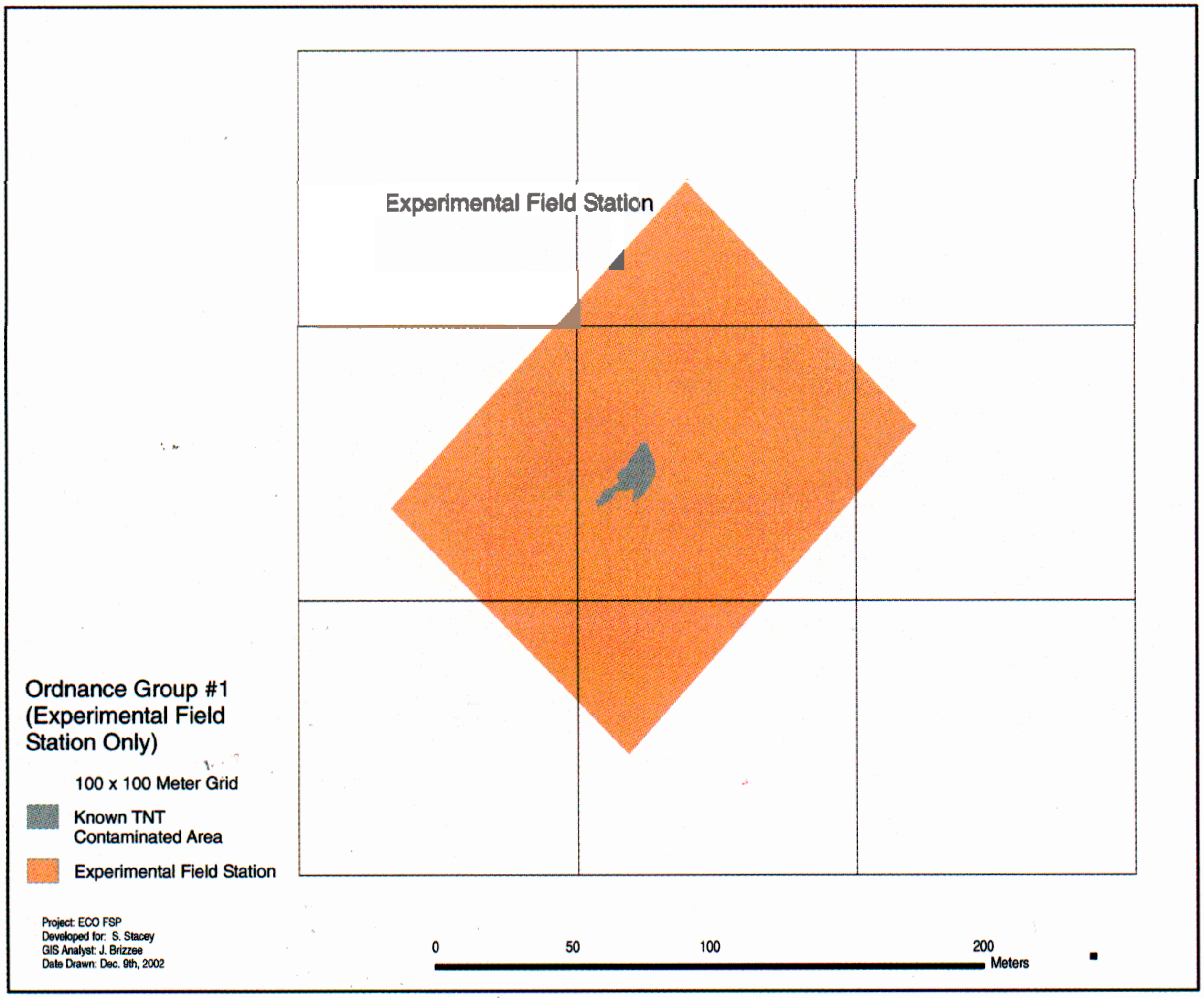
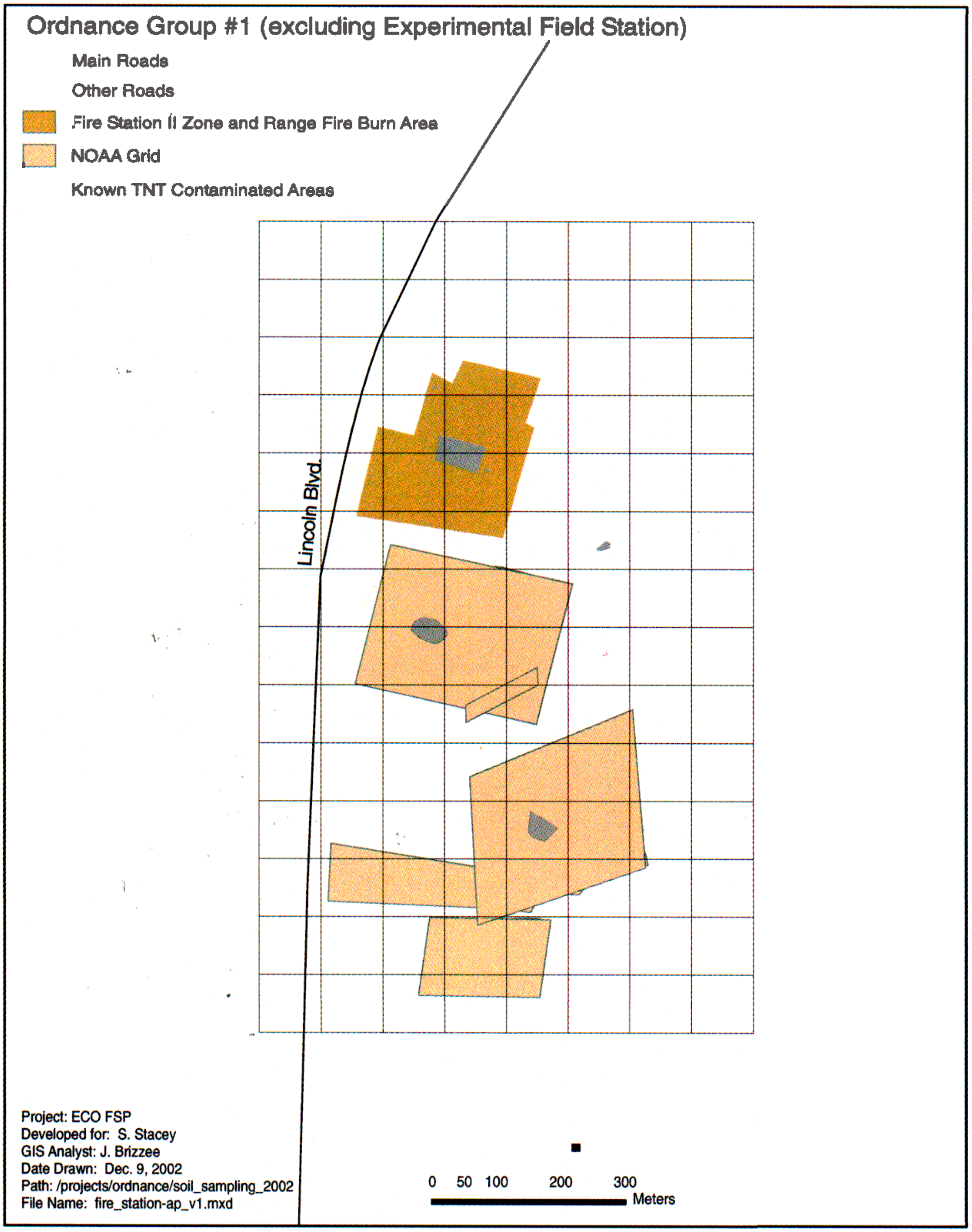


Figure 3-1. TRA with 100×100 m grid for the selection of plots.



03-GA50101-02

Figure 3-2. Eastern Ordnance Group # 1 site with 100 × 100 m grid for the selection of plots.



03-GA50101-01

Figure 3-3. Western Ordnance Group #1 sites with 100 × 100 m grid for the selection of plots.

If site-related contaminants are not elevated and no effects are evident relative to the reference areas, then further sampling (for monitoring or otherwise) will not be performed unless indicated by the LTEM Plan assessment.

3.6 Step 6—Specify Tolerable Limits on Decision Errors

There are two null hypotheses (H_0), one for the analytical data types and one for the effects data types. The data collected under LTEM will have components that contain both statistical and nonstatistical design aspects. In general, the H_0 for each of the analytical data types states that concentrations in biotic or abiotic media exceed the reference areas. The alternative hypothesis (H_A) states that concentrations in biotic or abiotic media are the same as the reference areas. The H_0 for the effects data types states that effects in biotic media are different from the reference areas. The H_A states that effects in biotic media are not different from the reference areas.

False acceptance of either H_0 would result in possible wasted cost and the effort of additional data collection and evaluation. There is a low likelihood of a more severe consequence involving reevaluation of the ROD and site remediation. False rejection of either H_0 would result in excess potential for adverse effects to ecological receptors. The consequences of a false rejection may range from low to severe, and the actual consequences are difficult to predict. Based on previous evaluations, it is expected that most effects will be localized.

3.7 Step 7—Optimize the Sampling Design

The purpose of this step in the DQO process is to identify the most resource-effective design for generating data to support decisions. Both the sampling locations and sampling sizes were evaluated to optimize the design for statistical assessment.

3.7.1 Sampling Locations

Sampling will be performed at each AOC using a stratified random approach. This will be implemented by placing a 100 × 100 m (110 × 110 yd) grid consisting of 100-m^2 (120-yd^2) cells over the areas of known or suspected contamination (i.e., the exposure area) identified from historical site knowledge. The exposure area grid will be divided into potentially impacted subareas using professional judgment based on historical information concerning radiological or chemical concentrations in soil or distance to the source area. Samples will be located randomly, but will be allocated to each of the recognized potentially impacted subareas in the exposure area. The number of samples in a subarea will be proportional to the dimension of the area, unless some known reason to do otherwise exists. Thus, smaller subareas will have fewer samples than larger subareas.

A field reconnaissance will be used to assess presence and abundance of a species within each randomly selected 100 × 100 m (110 × 110 yd) grid. Based on professional judgment, if the grid cell is too disturbed, if species for sampling are not present, or if other experiments and activities may be disturbed, the nearest appropriate grid cell will be selected.

A field reconnaissance of potential reference areas will also be completed in order to match the reference areas and the AOCs to the greatest extent possible. Potential reference areas with soil types similar to the AOCs and reference areas that have not been recently burned are identified in Figure 1-3. Final selection of the reference areas and sampling grid cells will be based on presence of suitable species and access.

The grid cell size will represent a plot that is considered large enough to incorporate changes and natural variability observed in patchy habitats, yet small enough to correlate soil concentrations with biota concentrations or physiological effects. A larger cell size could dilute the relationship between soil concentration and effects, whereas a smaller cell size could be subject to more variability in community parameters.

The two AOCs identified in the LTEM Plan (INEEL 2003) for sampling during 2003 are Ordnance Area #1 (discussed in Section 1.2.1) and TRA (discussed in Section 1.2.2). The maps showing the locations of the grids indicating the areas of possible elevated contaminant concentrations for TRA are presented in Figure 3-1 for TRA and in Figures 3-2 and 3-3 for Ordnance Area #1.

As shown in Figure 3-1, the grid at TRA is divided into four locations. From each subarea, two to three cells will be randomly selected, proportional to the total size of each subarea. Ten grid cells will be sampled from TRA in 2003.

Since the section of Ordnance Area #1 identified in Figure 3-3 will be identified as one subarea, nine plots (or grid cells) will be randomly located within this subarea. Although the remaining subarea at Ordnance Area #1 (Figure 3-2) is so small that one grid cell represents the total area, it will be used as one plot.

3.7.2 Sample Size

Table 3-2 presents the relationship between sample size and statistical performance. It is desirable to maintain a coefficient of variation (CV) at or below 20%; however, in the analysis of multiple sample matrices and analytes, the overall CV may be higher. The CV, also known as the relative standard deviation, is the ratio of the standard deviation to the mean (or average).

Previous sampling for ecological receptors was conducted at the BORAX site (DOE-ID 2001). The average CV for deer mice and soil was calculated from the five samples taken at each location. For deer mice, the average CV was 23% with a maximum of 77%. The average CV for surface soil was 18%, with a maximum of 44%. The average CV for subsurface soil was 25%, with a maximum of 78%. Based on this information compared to Table 3-2, it is necessary to have a large sample size to detect differences for some analytes.

It was decided that each exposure area will have ten total samples of each media obtained. These samples will be collected from ten separate grid cells within the area. Only grid cells in the potentially impacted subareas will be sampled. The reference area(s) will also have a total of ten samples collected from each of ten grid cells measuring 100 m^2 (120 yd^2). Ten samples were selected as the accepted size based upon professional judgment, balancing the cost to collect the data against the need to obtain adequate statistical power to detect any difference that exists. After FY 2003 sampling, the variability in the data will be evaluated and sample size requirements for each data type will be verified.

It is accepted that the number of samples may not be adequate to detect differences at an individual AOC. However, for the ongoing assessment, each year's sampling effort will be combined, and each year of data greatly increases the ability to detect differences.

Table 3-2. Relationship of statistical performance to sample number required.

CV (%)	Power (%)	Confidence Level (%)	Samples Required to Meet a Minimum Detectable Relative Difference 5%	10%	20%
10	95	90	36	10	3
15	95	90	78	21	6
20	95	90	138	36	10
25	95	90	216	55	15
30	95	90	310	78	21
35	95	90	421	106	28
30	95	80	—	—	15
20	90	95	—	—	10
30	90	80	—	—	11
40	90	80	—	—	19
40	90	90	—	—	28
40	95	95	—	—	45
40	90	95	—	—	36
20	90	80	—	—	5
15	90	80	—	—	3
15	90	80	—	—	5
25	95	95	—	—	19
25	95	90	—	—	15

— Not calculated.
Reference: EPA 1989.

4. SAMPLE COLLECTION, ANALYSIS, AND DATA MANAGEMENT

4.1 Sample Collection

4.1.1 Presampling Meeting

Before sampling takes place, project personnel will meet to ensure sampling and analysis can be performed in a safe manner, and will provide the project with usable data. Project personnel also ensure all necessary equipment and documentation are present and all personnel understand the project scope and objectives.

4.1.2 Sampling and Analysis Requirements

Tables 4-1 through 4-3 provide summaries of the areas to be sampled and the analyses to be performed for this sampling activity. Table 4-4 identifies the total sample volume, number of samples, and total samples required for each analysis. Table 4-5 identifies the types, maximum holding times, and preservative requirements that apply to samples being collected under this FSP.

The INEEL SAM is responsible for obtaining laboratory analytical services for the required analyses per MCP-9439, "Preparation for Environmental Sampling Activities at the INEEL." The SAM will prepare task order statements of work (TOSs) documents if needed for laboratory services.

The maximum sample holding times are listed in Table 4-5 and are defined from the date of sample collection to the date of sample preparation or analysis. Samplers coordinate with the analytical laboratory to ensure the samples arrive at the laboratory to meet holding times. Maximum holding times for biota samples are not established; however, approval of holding times of 6 months to 1 year is likely based upon other ecological studies (Marsh et al. 1998). The approved holding times will be followed, and the laboratory workload will be arranged to maximize sample analysis and to meet sample holding times.

Sample preservation is conducted to ensure that target analytes do not escape from field samples or become chemically attached to sample containers before analysis. Typical sample preservation activities include the addition of acids or cooling the samples to a designated temperature. Applicable preservation requirements for this sampling activity are identified in Table 4-5. Biotic samples will be preserved by holding the samples at 4°C.

As required, quality control samples will be taken throughout this project. If for some reason a sample is lost, containers are broken, or the sample is in some way unusable, the sample will be retaken. The sampling FTL ensures that any changes to this document regarding sampling frequency, location, and/or analyses are documented in the sample logbook. The PM is responsible for ensuring a document action request (DAR) is written and approved for any changes to this document.

A sampling logbook containing a written record for all field data gathered, field observations, field equipment calibrations, samples collected for analysis, and sample custody will be prepared. Field logbooks are legal documents that are maintained to ensure field activities are properly documented as they relate to site safety meetings and site work being conducted in accordance with the health and safety procedures. Field logbooks are bound and contain consecutively numbered pages. All entries in field logbooks are made using permanent ink pens or markers. The person making corrections to mistakes on an entry should draw a single line through the entry and then initial and date the correction.

Table 4-1. Biased composite biotic and collocated soil samples for contaminant analysis at Ordnance Group #1.

Analytes	Sample Depth	Sample Media	Sample Type	Number of Samples
Nitroaromatics	0 to 2 in.	Soil	Surface composite—up to 5 borings/plot	10
	2 to 24 in.	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 3 to 5 animals/plot	10
	NA	Sagebrush	Composite of 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of 5 plants/plot	10
Selected radionuclides	0 to 2 in.	Soil	Surface composite—up to 5 borings/plot	10
	2 to 24 in.	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 3 to 5 animals/plot	10
	NA	Sagebrush	Composite of 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of 5 plants/plot	10

a. Or other wheatgrasses, as appropriate. See Appendix B, Section B2.1.1.
NA = not applicable.
Note: No duplicates for biota will be collected. Matrix duplicates will be prepared by the laboratory from the appropriate digestates.

Table 4-2. Biased composite biotic and collocated soil samples for contaminant analysis at TRA.

Analytes	Sample Depth	Sample Media	Sample Type	Number of Samples
Selected metals[a]	0 to 2 in.	Soil	Surface composite—up to 5 borings/plot	10
	2 to 24 in.	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 3 to 5 animals/plot	10
	NA	Sagebrush	Composite of 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of 5 plants/plot	10
Selected radionuclides	0 to 2 in.	Soil	Surface composite—up to 5 borings/plot	10
	2 to 24 in.	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 3 to 5 animals/plot	10
	NA	Sagebrush	Composite of 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of 5 plants/plot	10

a. Or other wheatgrasses, as appropriate. See Appendix B, Section B2.1.1.
NA = not applicable.
Note: No duplicates for biota will be collected. Matrix duplicates will be prepared by the laboratory from the appropriate digestates.

Table 4-3. Biased composite biotic and collocated samples for contaminant analysis at the reference areas.

Analytes	Sample Depth	Sample Media	Sample Type	Number of Samples
Nitroaromatics	0 to 2 in.	Soil	Surface composite—up to 5 borings/plot	10
	2 to 24 in.	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 3 to 5 animals/plot	10
	NA	Sagebrush	Composite of 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of 5 plants/plot	10
Selected metals	0 to 2 in.	Soil	Surface composite—up to 5 borings/plot	10
	2 to 24 in.	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 3 to 5 animals/plot	10
	NA	Sagebrush	Composite of 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of 5 plants/plot	10
Selected radionuclides	0 to 2 in.	Soil	Surface composite—up to 5 borings/plot	10
	2 to 24 in.	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 3 to 5 animals/plot	10
	NA	Sagebrush	Composite of 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of 5 plants/plot	10

a. Or other wheatgrasses, as appropriate. See Appendix B, Section B2.1.1.
NA = not applicable.
Note: No duplicates for biota will be collected. Matrix duplicates will be prepared by the laboratory from the appropriate digestates.

Table 4-4. Summary of sampling size requirements.

Sample Type	Gross or Composite Sample (net weight)	ICP Metals (grams)	Gross Alpha/Beta Spectroscopy (grams)	Alpha Spectroscopy (grams)	Gamma Spectroscopy (grams)	Beta Spectroscopy (grams)	GFAA/CVAA[a] Metals (grams)	Container	Total #
Animal (deer mouse)	60 g	10	10	10	10	10	2 g minimum per analyte	Plastic gallon bag	30
Vegetation (sagebrush)	150 g	10	10	10	10	10	2 g minimum per analyte	Plastic gallon bag	30
Vegetation (crested wheatgrass)	150 g	10	10	10	10	10	2 g minimum per analyte	Plastic gallon bag	30
Soil (surface)	500 g	10	10	10	10	10	2 g minimum per analyte	Polyethylene jar (500 mL)	30
Soil (subsurface)	500 g	10	10	10	10	10	2 g minimum per analyte	Polyethylene jar (500 mL)	30
Bioassay - plant and earthworm (surface and subsurface soil composite)	4 to 8 L	NA	NA	NA	NA	NA	NA	Polyethylene jug (1 gallon)	30
Invertebrate community structure (surface and subsurface soil composite)	500 g	NA	NA	NA	NA	NA	NA	Plastic quart bag/ polyethylene jar (100 mL)	30

a. ICP = Inductively Coupled Plasma
GFAA = Graphite Furnace Atomic Absorption
CVAA = Cold Vapor Atomic Absorption

NA = not applicable.

Table 4-5. Summary of sampling collection, holding time, analytical methods, and preservation requirements.

Analysis	Sample Medium	Volume	Container Type	Holding Time[a]	Analytical Methods: Soil	Analytical Methods: Biota	Preservative
Gamma spectroscopy/ α/β-Radiochemistry	Soil	16 oz	Wide mouth plastic jar	Analyze within 6 months.[b]	Gamma spectroscopy/alpha and beta radiochemistry	Gamma spectroscopy/alpha and beta radiochemistry	None
Nitroaromatics	Soil	500 g	Wide mouth plastic jar	Analyze within 14 days.	SW-846 Method 8330	SW-846 Method 8330	4°C [c]—None
Selected metals	Soil	500 g	Wide mouth plastic jar	Analyze within 6 months, except Hg, which should be analyzed within 28 days.[c]	SW-846 Method 6010B	SW-846 Method 6010B	4°C [c]—None
Bioassay	Soil	4 to 8 L	Polyethylene jug or large sealable plastic bag	Analyze within 6 months.[b]	ASTM standard E1676-97/ ASTM standard E-1598-94	ASTM standard E1676-97/ ASTM standard E-1598-94	4°C [c]—None

a. Biota holding times are presumed to be the same as soils.
b. There is no reference for this holding time; it is based on EPA Contract Laboratory Program guidance for metallic elements or professional judgment.
c. EPA 1993.

4.1.3 Sample Documentation and Management

The FTL controls and maintains all field documents and records, and submits required documents to the Administrative Record and Document Control Office at the conclusion of the project. The appropriate information pertaining to each sample is recorded in accordance with MCP-1194, "Logbook Practices for ER and Deactivation, Decontamination, and Decommissioning Projects," MCP-1192, "Chain-of-Custody and Sample Labeling for ER and D&D&D Projects," and the QAPjP (DOE-ID 2002b). The person designated to complete the sample or FTL logbook records items such as presampling safety meeting notes, weather, and general project notes in the logbook, as appropriate. Proper handling, management, and disposal of samples under the control of Bechtel BWXT Idaho, LLC, or its subcontractors, are essential. All samples are dispositioned in accordance with the appropriate procedures.

If it becomes necessary to revise these or other project documents, a DAR will be executed in accordance with MCP-233, "Process for Developing, Releasing, and Distributing ER Documents." DARs can include additional analyses that may be necessary to meet appropriate waste acceptance criteria.

4.1.4 Sampling Equipment

Table 4-6 includes a list of equipment and supplies similar to the list presented in TPR-145. This list is as extensive as possible and includes equipment for both the analytical and effects data collection; however, it is not exhaustive, and should only be used as a guide.

4.1.4.1 Field Equipment Calibration and Set-Up. The FTL works closely with sampling personnel to ensure sampling equipment is operating as recommended by the manufacturer and according to design specifications. Presampling inspections of equipment are performed to ensure the equipment is functioning properly. Corrective actions for repair or maintenance of any sampling equipment are immediate and are confirmed by the FTL or PM before proceeding with sampling.

Radiological control personnel are responsible for the calibration of all radiological monitoring equipment and the placement and handling of telemetry dosimeters. Industrial hygiene is responsible for the measurement and evaluation of other chemical hazards. All calibrations are documented in the calibration logbooks.

4.1.5 Sample Designation and Labeling

Each sample bottle contains a label identifying the field sample number, the analyses requested, the sample date and time, and the sampler. Labels are secured on the sample using clear plastic tape.

Uniqueness is required to maintain consistency and prevent the same identification code being assigned to more than one sample. A systematic character code may be used to uniquely identify all samples.

4.1.6 Chain-of-Custody

Chain-of-custody (COC) procedures begin immediately after collection of the first sample. At the time of sample collection, the sampling team initiates a COC form for each sample. All samples remain in the custody of a member of the sampling team until custody is transferred to the analytical laboratory sample custodian. Upon receipt at the laboratory, the sample custodian reviews the sample labels and the COC form to ensure completeness and accuracy. If discrepancies are noted during this review, immediate corrective action is sought with the sampling team member(s) relinquishing custody as identified on the COC. Pending successful corrective action, the laboratory sample custodian signs and dates the COC form, signifying acceptance of delivery and custody of the samples.

Table 4-6. Equipment and supplies list.

	Plot Preparation	Proximal Soil Sampling	Mammal Sampling		Vegetation Sampling	
		Analytical	Effects	Analytical	Effects	Analytical
Flexible tape, 50 m or longer	X	X		X		X
1 m ruler	X	X		—		X
Survey stakes	X	—		X		X
Small sledgehammer	X	—		—		—
Field forms, logbooks, and clipboards	X	X		X		X
Survey tape (various colors)	X	X		X		X
Compass	X	X		X		X
Wildlife identification information	—	—		X		—
Small (mouse-sized) and medium (rabbit-sized) live traps	—	—		X		—
Absorbent material (e.g., paper towels and cloth rags)	—	X		X		X
Permanent markers, sample labels, and bar codes	X	X		X		X
Latex gloves	—	X		X		X
EPA-approved sampling containers as specified by the analytical method (see QAPjP)	—	X		X		X
Sampling logbook						
Sealable plastic bags (various sizes)	—	X		X		X
Strapping tape and duct tape	—	X		X		X
Distilled, deionized water (including decontamination water)	—	X		X		X
Sample preservatives as specified by analytical method (see FSP and QAPjP)	—	X		—		—
Plastic tubs for rinsing sampling equipment	—	X		X		X
Tweezers, tongs, and forceps	—	—		X		X
PPE, as specified by the JSA	X	X		X		X
Plastic bubble-wrap, starch packing beads, or foam sheeting for sample shipment (no diatomaceous earth)	—	X		X		X
Laboratory scales: 2-kg capacity with 0.1-g resolution; 200-g capacity with 0.01-g resolution	—		X	X		X
GPS	X	—		—		—
Bleach for decontamination of traps and sampling tools	—	—		X		—

Table 4-6. (continued).

	Plot Preparation	Proximal Soil Sampling	Mammal Sampling		Vegetation Sampling	
		Analytical	Effects	Analytical	Effects	Analytical
Scales for weighing animals (various sizes)	—	—		X		—
Stainless steel pans	—	X		X		X
Stainless steel scoops for soil sampling	—	X		—		—
Stainless steel auger	—	X		—		—
Plastic containers (e.g., carboys) for containing used rinse water	—	X		X		X
Minimum and maximum recording thermometers or thermometer labels	—	X		X		X
Leather gloves (various sizes)	X	X		X		X
CO_2 (dry ice)	—	—		X		—
Plant press	—	—		—		X
Large and small coolers	—	X		X		X
Reusable ice packs	—	X		X		X
Shovels	X	—		—		—
Grass clippers	—	—		—		X
Pruning shears	—	—		—		X
Bait (peanut butter, molasses, grains)						

4.1.7 Sample Collection Procedures

Sample collection for laboratory analysis follows the procedures in Appendix B and in TPR-145.

4.1.8 Equipment Decontamination Procedures

The decontamination procedure in TPR-6575, "Decontaminating Sampling Equipment in the Field," will be followed for the majority of the sampling equipment used by this project. Some of the equipment (e.g., traps) will require the use of bleach in addition to the typical cleaning solutions.

4.1.9 Sample Transport

Field team members prepare the samples for transport per MCP-1193, "Handling and Shipping Samples for ER and D&D&D Projects," by securing the labels using clear tape, placing parafilm on the bottles to secure the lids, and placing the bottles in sealed bags. The field team member wraps the samples in plastic bubble wrap, or other cushioning material, and places them in the sample cooler. If necessary, the field team member places blue ice in the cooler to maintain the required temperature. The field team member places the completed and signed COC form in the cooler, tapes the cooler shut, and places the custody seals on the cooler to prevent tampering.

The field team member completes the applicable shipping papers (the 460 or 461 forms series, as applicable), secures address labels to the cooler, and delivers the coolers to the shipping authority for transport.

4.1.10 Waste Management

All samples are dispositioned under the guidance of the project WGS representative. The analytical laboratory disposes of samples submitted to them for analyses or returns them to the requestor as stated in the applicable TOS(s). Samples returned from the laboratory are accepted only if the original label is intact and legible. If the samples are returned, the PM is responsible for properly disposing of the sample with the assistance of WGS personnel. All waste must be characterized and disposal must be preapproved and documented by WGS personnel.

4.1.10.1 Solid Waste Management. Solid waste generated includes PPE trash and miscellaneous waste such as wipes and packaging. Waste that does not come into direct contact with the sampled media or sampling equipment can be disposed of as nonconditional "cold" waste at the Central Facilities Area landfill complex unless beta/gamma radiation or contamination above INEEL release criteria is detected.

All PPE and other waste material directly used in sampling, decontamination, etc., is bagged, and placed in containers recommended by WGS, who ensures proper disposition of the waste.

In the unlikely event that nonhazardous radioactive waste is generated, it will be disposed of at the Radioactive Waste Management Complex (RWMC) or the Waste Experimental Reduction Facility (WERF). WGS will approve and prepare individual waste streams destined for disposal at RWMC or WERF in accordance with INEEL criteria (DOE-ID 2002a).

4.1.10.2 Soil Specific Waste Management. Offsite laboratories dispose of both altered and unaltered samples as contractually required. However, as mentioned previously, onsite laboratory gamma screening of samples may be required, and these laboratories do not dispose of soil samples. Generally, returned samples should be restored to the collection site. In the event that samples must be returned from the laboratory, only unused, unaltered samples in the original containers are accepted. Although no samples are expected to be returned from any laboratory, and all samples are expected to be eligible for return to the collection site, disposition of samples that are returned (for whatever reason) and that cannot be restored to a collection site is coordinated with the appropriate waste generator interface. Such coordination helps to ensure compliance with applicable waste characterization, treatment, and disposal regulations.

Decontamination solutions used in small quantities may include deionized water, detergent, bleach/water, and isopropanol. It is anticipated that containment of decontamination fluids will not be required during sampling. Using spray bottles to apply the fluids will minimize the amount of decontamination fluids produced. Excess fluid will be allowed to drain onto the ground in the staging area used during sampling.

4.1.10.3 Waste Minimization. Waste reduction philosophies and techniques will be emphasized, and personnel will be encouraged to continuously attempt to improve methods. No one will use, consume, spend, or expend equipment or materials carelessly. Practices to be instituted to support waste minimization include, but are not limited to the following:

- Restrict material (especially hazardous material) entering control zones to that needed for performance of work
- Substitute recyclable or burnable items for disposable items

- Reuse items when practical
- Segregate contaminated from uncontaminated waste.
- Segregate reusable items such as PPE and tools.

Wastes generated during the characterization project include samples, sampling equipment, and PPE. These articles are handled, characterized, and disposed of in accordance with the *INEEL Reusable Property, Recyclable Materials and Waste Acceptance Criteria (RRWAC)* (DOE-ID 2002a). Personnel from WGS coordinate waste disposal activities in accordance with INEEL procedures. Waste is bagged, placed in containers, labeled, and stored in an approved storage area pending disposition. The PM, with assistance from WGS, prepares waste determination and disposition forms for determining the disposition routes for all waste generated during sampling and analysis.

4.2 Sample Analysis

Sample analysis is performed by laboratories approved by the INEEL SAM. These laboratories analyze the samples in accordance with project requirements, including the ER-SOW-394, "Idaho National Engineering and Environmental Laboratory Sample and Analysis Management Statement of Work for Analytical Services."

Project-specific request for analyses forms or TOS(s) identify additional requirements for laboratory analysis. The following sections identify analysis requirements for the characterization project.

4.2.1 Analytical Methods

To ensure that data of acceptable quality is obtained from the characterization project, standard EPA laboratory methods or technically appropriate methods for analytical determinations are used to obtain sample data. Analytical methods to be used for this characterization activity are identified in Table 1-1. Any deviations from this information will be fully documented, and the laboratory will inform the technical lead of the deviations.

4.2.2 Instrument Calibration Procedures

Laboratory instruments are calibrated in accordance with each of the specified analytical methods. The laboratory quality assurance plan must include requirements for calibrations when specifications are not listed in analytical methods. Calibrations that are typically not called out in analytical methods include ancillary laboratory equipment and verification of reference standards used for calibration and standard preparation. Laboratory documentation includes calibration techniques and sequential calibration actions, performance tolerances provided by the specific analytical method, and calibration dates and frequency. All analytical methods have specifications for equipment checks and instrument calibrations. The laboratory complies with all method-specific calibration requirements for all requested parameters. If failure of instrument calibration or equipment is detected, then the instrument will be recalibrated, and all affected samples will be analyzed using an acceptable calibration.

4.2.3 Laboratory Records

Laboratory records are required to document all activities involved in sample receipt, processing, analysis, and data reporting. Sample management records document sample receipt, handling and storage, and the sample analysis schedule. The records verify that the COC and proper preservation are maintained, reflect any anomalies in the samples, note proper log-in of samples into the laboratory, and address procedures used to prioritize received samples, ensuring that the holding time requirements are met.

The laboratory is responsible for maintaining documentation demonstrating laboratory proficiency with each method as prescribed in standard operating procedures. Laboratory documentation includes sample preparation and analysis details, instrument standardization, detection and reporting limits, and test-specific quality control criteria. Any deviations from prescribed methods must be properly recorded. Quality assurance/quality control reports include general quality control records, such as analyst training, instrument calibration, routine monitoring of analytical performance, and calibration verification. Project-specific information, such as blanks, spikes, calibration check samples, replicates, and splits performed per project requirements, may be performed and documented. Specific requirements for the quantity and types of quality assurance or quality control monitoring and associated reporting formats will be specified in the task-specific laboratory statement of work.

4.3 Data Management and Document Control

4.3.1 Data Reporting

A basic ordering agreement standard deliverable is required for all data reported for this characterization project. The final data documentation package conforms to the criteria specified in ER-SOW-394.

The ER SOW, prepared by the INEEL SAM organization, is the standard for analytical data deliverable requirements, defined by INEEL projects, for the laboratories used by the INEEL. The document used to establish technical and reporting standards will be adhered to by all laboratories.

4.3.2 Data Validation

Analytical data validation is the comparison of analytical results with the requirements established by the analytical method. Validation involves evaluating all sample-specific information generated from sample collection to receipt of the final data package. Data validation is used to determine if analytical data are technically and legally defensible and reliable. The final product of the validation process is the validation report. This report communicates the quality and usability of the data to the decision-makers.

All data generated for this project undergoes independent validation. The INEEL SAM arranges for validation. Level B validation is requested for all sample data reports generated during this project. The validation report contains an itemized discussion of the validation process and results. Copies of the data forms annotated for qualification are attached to the report.

4.3.3 Data Quality Assessment

The data quality assessment process determines whether the data meet the project DQOs. This process may involve data plotting, testing for outlying data points, and other statistical analysis relative to the characterization project DQOs.

The completeness of the data is determined by comparing the number of samples collected and analyzed to the number of samples planned. For this characterization plan, a 90% completeness objective for all analyses has been established because some sample locations may not contain enough material for all analyses requested.

Precision is the degree to which replicate measurements of the same property agree. Accuracy is a measure of the closeness of an individual measurement to the true value. Field and laboratory precision and accuracy should be within the limits and goals established in the QAPjP. Data results will be evaluated upon completion of the project to determine whether precision and accuracy goals are met.

4.3.4 Final Characterization Report

A final characterization report will be prepared for this project per applicable program requirements. This report will contain a summary of all the sample data generated during this sampling effort; appendixes containing all sample results may be attached. It will describe the sample collection effort, and may include a description of the data quality assessment process. It will also discuss how the data will be used, and will review and evaluate the DQOs to determine if the characterization project objectives have been met.

4.3.5 Document Control

Document control consists of clearly identifying all project-specific documents in an orderly form, securely storing all project information, and controlling the distribution of all project information. Document control ensures that controlled documents of all types related to the project receive appropriate levels of review, comment, and revision, as necessary. The project manager is responsible for properly maintaining project documents according to INEEL document control requirements. Upon completion of the characterization project, all project documentation and information will be transferred to compliant storage according to project, program, and company requirements. This information may include field logbooks, COC forms, laboratory data reports, engineering calculations and drawings, and final technical reports.

5. HEALTH AND SAFETY REQUIREMENTS

A health and safety plan is not required for this project. Instead, per the requirements of INEEL MCP-3562, a hazard screening checklist was completed for this characterization activity to identify all hazards associated with this project. Hazards identified on the checklist, along with corresponding mitigation requirements, were documented on a JSA per MCP-3450, "Developing and Using JSAs." In completing the JSA, technical input and approval is obtained by assigned ESH&QA personnel. The JSA identifies all potential hazards associated with this project.

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